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U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NUMBER

**TRANSMITTAL LETTER TO THE UNITED STATES  
DESIGNATED/ELECTED OFFICE (DO/EO/US)  
CONCERNING A FILING UNDER 35 U.S.C. 371**

027566-025

U.S. APPLICATION NO. (If known, see 37 C.F.R. 1.5)

UNASSIGNED **09/787762**INTERNATIONAL APPLICATION NO.  
PCT/FI99/00790INTERNATIONAL FILING DATE  
24 September 1999PRIORITY DATE CLAIMED  
25 September 1998

TITLE OF INVENTION

SIGNALLING IN A TELECOMMUNICATIONS SYSTEM

APPLICANT(S) FOR DO/EO/US

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Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and the PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
  - a. ☒ is transmitted herewith (required only if not transmitted by the International Bureau).
  - b. ☒ has been transmitted by the International Bureau.
  - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
  - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
  - b. ☐ have been transmitted by the International Bureau.
  - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
  - d. ☒ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A FIRST preliminary amendment.  
☐ A SECOND or SUBSEQUENT preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☒ Other items or information:

International Preliminary Examination Report, PCT Demand, Unexecuted Declaration

U.S. APPLICATION NO. (If known, see 37 C.F.R. 1.50)

UNASSIGNED

09/787762

INTERNATIONAL APPLICATION NO.

PCT/FI99/00790

ATTORNEY'S DOCKET NUMBER

027566-025

17. ☒ The following fees are submitted:

CALCULATIONS

PTO USE ONLY

**Basic National Fee (37 CFR 1.492(a)(1)-(5)):**

Neither international preliminary examination fee (37 CFR 1.482)  
nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO  
and International Search Report not prepared by the EPO or JPO ..... \$1,000.00 (960)

International preliminary examination fee (37 CFR 1.482) not paid to  
USPTO but International Search Report prepared by the EPO or JPO ..... \$860.00 (970)

International preliminary examination fee (37 CFR 1.482) not paid to USPTO  
but international search fee (37 CFR 1.445(a)(2)) paid to USPTO ..... \$710.00 (958)

International preliminary examination fee paid to USPTO (37 CFR 1.482)  
but all claims did not satisfy provisions of PCT Article 33(1)-(4) ..... \$690.00 (956)

International preliminary examination fee paid to USPTO (37 CFR 1.482)  
and all claims satisfied provisions of PCT Article 33(1)-(4) ..... \$100.00 (962)

**ENTER APPROPRIATE BASIC FEE AMOUNT =**

\$ 860.00

Surcharge of **\$130.00 (154)** for furnishing the oath or declaration later than  
months from the earliest claimed priority date (37 CFR 1.492(e)). 20 ☐ 30 ☐

\$ -0-

Claims	Number Filed	Number Extra	Rate		
Total Claims	26 -20 =	6	X\$18.00 (966)	\$ 108.00	
Independent Claims	3 -3 =	-0-	X\$80.00 (964)	\$ -0-	
Multiple dependent claim(s) (if applicable)			+ \$270.00 (968)	\$ -0-	

**TOTAL OF ABOVE CALCULATIONS =**

\$

Reduction for 1/2 for filing by small entity, if applicable (see below).

\$ -0-

**SUBTOTAL =**

\$ 968.00

Processing fee of **\$130.00 (156)** for furnishing the English translation later than  
months from the earliest claimed priority date (37 CFR 1.492(f)). 20 ☐ 30 ☐

\$ -0-

**TOTAL NATIONAL FEE =**

\$ 968.00

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by  
an appropriate cover sheet (37 CFR 3.28, 3.31). **\$40.00 (581)** per property +

\$ -0-

**TOTAL FEES ENCLOSED =**

\$ 968.00

Amount to be:  
refunded

\$

charged

\$

a. ☐ Small entity status is hereby claimed.b. ☒ A check in the amount of \$ 968.00 to cover the above fees is enclosed.c. ☐ Please charge my Deposit Account No. 02-4800 in the amount of \$ \_\_\_\_\_ to cover the above fees. A duplicate copy of this sheet is enclosed.d. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 02-4800. A duplicate copy of this sheet is enclosed.

**NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b))  
must be filed and granted to restore the application to pending status.**

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REGISTRATION NUMBER

Date: March 22, 2001

09/787762

JCO3 Rec'd PCT/PTO 22 MAR 2001

Patent  
Attorney's Docket No. 027566-025

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Patent Application of )  
Tomas MECKLIN et al. ) Group Art Unit: UNASSIGNED  
Application No.: UNASSIGNED ) Examiner: UNASSIGNED  
Filed: March 22, 2001 )  
For: SIGNALLING IN A )  
TELECOMMUNICATIONS SYSTEM )

**PRELIMINARY AMENDMENT**

Assistant Commissioner for Patents  
Washington, D.C. 20231

Sir:

Prior to examination, please amend the above-identified application as follows:

**IN THE CLAIMS:**

Please replace claims 3-7, 9-10, 13, 17-19 and 21-25 as follows.

3. (Amended) A method according to claim 1, further comprising formatting the signalling information at the first gateway into a format suitable for transmission over an IP network.

4. (Amended) A method according to claim 1, further comprising transmitting the formatted information from the first gateway to a second gateway over an IP network.

5. (Amended) A method according to claim 1, further comprising receiving the formatted information at the second gateway and recovering therefrom the original signalling information.

6. (Amended) A method according to claim 1, further comprising transmitting the recovered signalling information to a second signalling point.

7. (Amended) A method according to claim 1, wherein the signalling information being associated with a subscriber-to-subscriber voice or data traffic channel carried by a first transmission network.

9. (Amended) A method according to claim 1, wherein said signalling points between which the user call information and the signalling information is transmitted are switching points of the telecommunication system.

10. (Amended) A method according to claim 1 and comprising transmitting signalling information between said signalling points in part via a packet switched signalling network different from said IP based network, signalling information being converted from one format to another at the signalling network interfaces.

13. (Amended) A method according to claim 1, wherein the signalling information transmitted through the IP network comprises signalling information associated with call set-up and call termination in the first transmission network of the telecommunications system.

17. (Amended) An apparatus according to claim 15, wherein the gateway device is a standalone device.

18. (Amended) An apparatus according to claim 15, wherein the gateway device is integrated into respective signalling point.

19. (Amended) An apparatus according to claim 15, wherein the gateway device is coupled to the IP network via respective Internet Access Server (IAS).

21. (Amended) An apparatus according to claim 15, wherein the gateway device is coupled to respective signalling point via PCM or TDMA links.

22. (Amended) An apparatus according to claim 15, wherein the gateway device is provided with conversion means for converting between: the ISUP messaging format and the SIP messaging format; an H.323 messaging format and the SS7 call set-up format; ISUP and a network access server control protocol; or between ISUP and a voice-over-IP control protocol.

23. (Amended) An apparatus according to claim 15, wherein the gateway device may be provided with an interface for tunnelling SS7 application part messages over IP.

24. (Amended) An apparatus according to claim 15, wherein the gateway device is arranged to determine the IP routing address for a received message or series of messages from one or more of: the Signalling Link Selection + Service Information Octet; Subsystem number; and Global Title Translation.

25. (Amended) An apparatus according to claim 14, wherein signalling information is associated with a subscriber-to-subscriber voice or data traffic channel carried by a first transmission network.

**REMARKS**

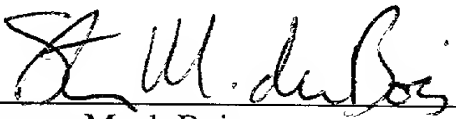
The Examiner's attention is drawn to the amendments to the application made in the Preliminary Examination Report, and for the convenience of the Examiner the following items are submitted with this application.

- A) International PCT Publication
- B) Preliminary Examination Report
- C) PCT Demand

The above changes to the claims have been made to delete multiple dependency of the claims, to round out the scope of patent protection being sought, and generally to place the claims in better condition for examination on the merits. These changes have been made in accordance with 37 C.F.R. § 1.121 as amended on November 7, 2000.

Respectfully submitted,

BURNS, DOANE, SWECKER & MATHIS, L.L.P.

By:   
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**Attachment to Preliminary Amendment dated March 22, 2001**

**Marked-up claims 3-7, 9-10, 13, 17-19 and 21-25**

3. (Amended) A method according to claim 1 [any of the preceding claims], further comprising formatting the signalling information at the first gateway into a format suitable for transmission over an IP network.

4. (Amended) A method according to claim 1 [any of the preceding claims], further comprising transmitting the formatted information from the first gateway to a second gateway over an IP network.

5. (Amended) A method according to claim 1 [any of the preceding claims], further comprising receiving the formatted information at the second gateway and recovering therefrom the original signalling information.

6. (Amended) A method according to claim 1 [any of the preceding claims], further comprising transmitting the recovered signalling information to a second signalling point.

7. (Amended) A method according to claim 1 [any of the preceding claims], wherein the signalling information being associated with a subscriber-to-subscriber voice or data traffic channel carried by a first transmission network.

9. (Amended) A method according to claim 1 [any of the preceding claims], wherein said signalling points between which the user call information and the signalling information is transmitted are switching points of the telecommunication system.

10. (Amended) A method according to claim 1 [any of the preceding claims] and comprising transmitting signalling information between said signalling points in part via a packet switched signalling network different from said IP based network, signalling information being converted from one format to another at the signalling network interfaces.

13. (Amended) A method according to claim 1 [any of the preceding claims], wherein the signalling information transmitted through the IP network comprises signalling information associated with call set-up and call termination in the first transmission network of the telecommunications system.

17. (Amended) An apparatus according to claim 15 [claims 15 or 16], wherein the gateway device is a standalone device.

18. (Amended) An apparatus according to claim 15 [any one of claims 15-17], wherein the gateway device is integrated into respective signalling point.

19. (Amended) An apparatus according to claim 15 [any one of claims 15-18], wherein the gateway device is coupled to the IP network via respective Internet Access Server (IAS).

21. (Amended) An apparatus according to claim 15 [any one of claims 15-20], wherein the gateway device is coupled to respective signalling point via PCM or TDMA links.

22. (Amended) An apparatus according to claim 15 [any one of claims 15-21], wherein the gateway device is provided with conversion means for converting between: the ISUP messaging format and the SIP messaging format; an H.323 messaging format and the SS7 call set-up format; ISUP and a network access server control protocol; or between ISUP and a voice-over-IP control protocol.

23. (Amended) An apparatus according to claim 15 [any one of the claims 15-22], wherein the gateway device may be provided with an interface for tunnelling SS7 application part messages over IP.

24. (Amended) An apparatus according to claim 15 [any one of the claims 15-23], wherein the gateway device is arranged to determine the IP routing address for a received message or series of messages from one or more of: the Signalling Link Selection + Service Information Octet; Subsystem number; and Global Title Translation.



25. (Amended) An apparatus according to claim 14 [any one of the claims 14-24], wherein signalling information is associated with a subscriber-to-subscriber voice or data traffic channel carried by a first transmission network.

Signalling in a Telecommunications SystemField of the Invention

- 5 The present invention relates to signalling in a telecommunications system and in particular, though not necessarily, to the transmission of signalling data associated with voice or data calls.

Background to the Invention

10

In a telecommunications system, signalling equipment and signalling channels are required for the exchange of information between system elements or nodes. In particular, this internode signalling informs the nodes of what is to be performed when a telephone or data call is to be set up or released in so-called "circuit-switched" connections. Modern telecommunications systems now largely make use of Common Channel Signalling (CCS) whereby signalling information is transmitted on one or more dedicated signalling channels, distinct from the channels used to carry actual user information (e.g. voice or data). An important feature of CCS is that the same signalling system may support services in a variety of existing telecommunications protocols, e.g. Public Switched Telephone Network (PSTN), Integrated Services Digital Network (ISDN), and Public Land Mobile Networks (PLMN), as well as proposed future protocols such as B-ISDN, enhancing greatly the interoperability of networks supporting different protocols.

- 25 Currently, the predominant CCS is known as Signalling System Number 7 (SS7), defined in the ITU-T (International Telecommunications Union - Technical) recommendations starting with Q.700. SS7 is a packet switched system occupying one time slot per frame of the Time Division Multiple Access (TDMA) E.1 or T.1 transmission formats (the other time slots being available for user data). Individual signalling message packets (datagrams) are associated with respective individual telephone calls. As only a relatively small amount of signalling information is
- 30

associated with a single telephone call, a single SS7 channel is able to handle all signalling between two network nodes (termed "signalling points") for several thousands of calls. It is noted that the route taken by a signalling message in the SS7 network may be the same as that over which the associated telephone call is  
5 established, or it may be different.

As already noted, SS7 (along with other CCS systems) is able to support a number of different telecommunications protocols (e.g. PSTN, ISDN, PLMN). In signal processing terms, SS7 comprises a Message Transfer Part (MTP) which deals with  
10 the physical transfer of signalling information over the signalling network, i.e. message formatting, error detection and correction, etc, and user parts and application parts which allow several "users" (i.e. ISDN User Part, Telephony User Part, etc) to send signals in the same signalling network.

15 SS7 makes use of addresses known as Point Codes to route signalling data through the "visibility area" of a telecommunications network, the visibility area typically being the network itself together with the interfaces between the network and "foreign" networks under the control of other operators. A Point Code is placed in the header of a signalling packet and is examined by a network signalling point (SP)  
20 upon receipt of the packet to determine the next hop for the packet *en route* to its destination.

In an SS7 network, any change in the Point Code allocation within the visibility area requires the operator to update the Point Code database (or routing table)  
25 which exists in each SP of the network. This however adds significantly to the maintenance overheads of the network. The dedicated nature of SS7 makes it in general expensive to install and maintain (in relation to both hardware and software), a significant barrier especially to prospective new telecom operators. Furthermore, as an SS7 network occupies bandwidth on TDMA frames of the  
30 E.1/T.1 transmission protocols (one slot per time frame), the bandwidth available for actual user call data is restricted. Yet another disadvantage of traditional

signalling architectures is that the interoperability of SS7 networks is limited due to the dedicated nature of the MTP physical layers.

#### Summary of the Present Invention

5

It is an object of the present invention to overcome or at least mitigate the above noted disadvantages of existing telecommunication signalling systems.

According to a first aspect of the present invention there is provided a method of  
10 transmitting signalling information between signalling points of a  
telecommunications system, the method comprising transmitting signalling  
information between said signalling points via a IP based network. The method  
preferably including the steps of transmitting signalling information from a first  
signalling point to a first gateway, formatting the signalling information at the first  
15 gateway into a format suitable for transmission over an IP network, transmitting the  
formatted information from the first gateway to a second gateway over an IP  
network, receiving the formatted information at the second gateway and recovering  
therefrom the original signalling information, and transmitting the recovered  
signalling information to a second signalling point.

20

Embodiments of the present invention enable the separation of information for  
transmission through the system into call information and signalling information.  
The use of the IP based network for transmitting signalling information releases  
capacity in the originating system for use by call information. In addition, the use  
25 of the IP network reduces the need for conventional signalling infrastructure  
(although this may still be used in part). IP based networks offer increased  
flexibility (e.g. routers of the network have self-updating routing tables) and  
reduced operating, maintaining, and engineering costs in comparison with  
conventional telecommunications signalling networks.

30

Preferably, the signalling information being associated with a subscriber-to-subscriber voice or data traffic channel carried by a first transmission network.

Preferably, said first transmission network is a circuit switched network, using for  
5 example PSTN, ISDN, or PLMN protocols, or a combination of these protocols.

Preferably, said signalling points between which the user call information and the signalling information is transmitted are switching points (e.g. exchanges) of the telecommunication system, or signalling transfer points. The IP based network may  
10 also be used *inter alia* to transmit signalling information to and from Intelligent Network nodes.

Signalling information may be transmitted between said signalling points in part via a packet switched signalling network different from said IP based network,  
15 signalling information being converted from one format to another at the network interfaces. For example, said packet switched signalling network may be a common channel signalling network such as a Signalling System No.7 (SS7) based network.

In a preferred embodiment of the present invention, signalling information is  
20 transmitted between a group of locally arranged signalling points using an SS7 network. Signalling information intended for signalling points outside the local area is transmitted to a gateway node which provides an interface between the SS7 network and the IP network. In the same way, the gateway node provides an interface for signalling information transmitted through the IP network to a local  
25 signalling point.

Preferably, the signalling data transmitted through the IP network comprises signalling information associated with call set-up and call termination in the first transmission network of the telecommunications system. Signalling information  
30 relating to call charging may also be transmitted through the IP network.

According to a second aspect of the present invention there is provided an apparatus for transmitting signalling information between signalling points of a telecommunications system, the apparatus include an Internet Protocol (IP) based network forming at least part of a transmission link between said signalling points, and means for transmitting signalling information between said signalling points via the IP based network. The apparatus preferably further include a gateway device coupled to a signalling point and also to an Internet Protocol (IP) based network, wherein the gateway device is arranged to receive signalling information from said signalling point coupled thereto and to convert that information into a format suitable for transmission over the IP network and to perform a reverse conversion for signalling information from the IP network.

Preferably, the gateway device is a Signalling System No.7 (SS7)/Internet Protocol (IP) gateway device.

In certain embodiments of the present invention, the gateway devices of the apparatus are standalone devices. In other embodiments, however, the gateway devices may be integrated into a signalling point or a signalling transfer point.

The gateway nodes may be coupled to the IP network via respective Internet Access Servers. Alternatively, the gateway nodes may be coupled directly to the IP network.

Preferably, the gateway nodes are coupled to respective signalling points/signalling transfer points via PCM or TDMA links, e.g. E.1 (2Mb/s, 32 channels) or T.1 (1.5Mb/s, 24 channels).

Preferably, the gateway nodes are coupled to respective IASs via packet switched data links, e.g. using ethernet or ATM.

The gateway devices may be provided with conversion means for converting between the ISUP messaging format and the SIP messaging format; between an H.323 messaging format and the SS7 call set-up format, between ISUP and a network access server control protocol, e.g. etheric; or between ISUP and a voice-over-IP control protocol, e.g. Q.767++.

The gateway devices may be provided with an interface for tunnelling SS7 application part messages over IP. For example, the gateway devices may each have one of the following protocol stacks arranged on the SS7 and IP sides:

SS7 side	IP side
ISUP/MTP	ISUP/IP
MAP/TCAP/MTP	MAP/TCAP/IP
INAP/TCAP/MTP	INAP/TCAP/IP

The gateway nodes may be arranged to determine the IP routing address for a received message or series of messages from one or more of the Signalling Link Selection + Service Information Octet, Subsystem number, and Global Title Translation.

Preferably, the signalling information is associated with a subscriber-to-subscriber voice or data traffic channel carried by a first transmission network.

According to a third aspect of the present invention there is provided a method of communicating voice and other user information between a pair of end users, a first of the end users having a circuit switched connection to a telecommunications network and the second of the end users having a packet switched connection to an IP network, the method comprising exchanging signalling information between the telecommunications network and the IP network via a gateway device arranged to convert the signalling data between a voice-over-IP format and an SS7 format.

#### Brief Description of the Drawings

For a better understanding of the present invention and in order to show how the same may be carried into effect reference will now be made, by way of example, to the accompanying drawings, in which:

5           Figure 1 illustrates schematically a telecommunications system comprising two interconnected telecommunications networks;

          Figure 2 illustrates functionally the architecture of a gateway device of the system of Figure 1;

          Figure 3 illustrates schematically the signal processing layers of the SS7  
10   protocol;

          Figure 4 illustrates the processing layers present at a gateway node of the system of Figure 1;

          Figure 5 illustrates the flow of signalling data associated with call set up and termination in the system of Figure 1; and

15           Figure 6 is a flow diagram illustrating the signalling process employed in the system of Figure 1.

#### Detailed Description of Certain Embodiments

20   A telecommunications system in which the present invention may be employed typically comprises one or more interconnected telecommunications networks. These networks may make use of the same telecommunications protocols (e.g. ISDN, PSTN, PLMN) or may use different protocols. In addition, the networks may be operated by the same or by different operators. However, the networks  
25   have in common that they use Signalling System No.7 for communicating signalling information between internally located signalling points (SP).

          Considering Figure 1, this illustrates a much simplified telecommunications system comprising only two telecommunications networks 1,2. Both of these networks 1,2  
30   are assumed to be Integrated Digital Services Networks (ISDN). Each network comprises a number of switching exchanges 3 interconnected by trunk lines 4. In



addition, a trunk line 5 provides a link between exchanges 3 of the two networks 1,2.

In order to connect a call, placed from a first subscriber telephone 6 (A-subscriber) to a second subscriber telephone 7 (B-subscriber) connected to local exchanges of the respective networks, it is necessary for the system to reserve a traffic channel between each of the four illustrated exchanges 3, using the trunk lines 4,5. Each traffic channel is a circuit switched channel, i.e. comprising a reserved time slot in each consecutive transmission frame, and as such the network through which a call is routed is referred to here as a "circuit-switched network".

As already mentioned above, conventionally, the interexchange signalling required to set up the various circuit switched channels is conveyed by SS7. In the system of Figure 1, an SS7 network 8 is provided in each of the telecommunications networks 1,2. Each SS7 network 8 handles the flow of signalling information between signalling points (e.g. exchanges 3) of the associated network. Signalling information may be routed directly between two signalling end points, or it may be routed through intermediate Signalling Transfer Points (STP) 9. It will be appreciated that although the SS7 networks are illustrated in Figure 1 as being distinct from the circuit switched network, the SS7 networks may make use of the trunk lines 4 for transmitting signalling data, and that the STPs 9 may be associated with respective exchanges 3.

Each of the networks 1,2 comprises a gateway device 10 which provides an interface for the SS7 network 8 to an IP network 11. In Figure 1, the gateway devices 10 are coupled to the IP network 11 via respective Internet Access Servers 12, although it will be appreciated that this coupling may be achieved directly without intervening Internet Access Servers 12.

It is noted here that the term "IP network" is intended to include networks utilising the current *de facto* IP standard as defined by the Internet Engineering Taskforce or

a future derivative thereof (including the TCP or UDP protocol layers). The network 11 may be a closed network under the control of the telecommunications network operator(s), i.e. an intranet, or an open network accessible through the World Wide Web (i.e. the Internet). In either case, the substitution of the IP  
5 network for a significant part of the SS7 network provides a number of significant advantages, chiefly a reduction in the signalling traffic and processing required in the conventional telecommunications network and replacement of expensive, dedicated telecommunications infrastructure with low cost, flexible datacom infrastructure.

10

For each of the networks 1,2, the gateway device 10 is coupled on the one side to the Internet Access Server 12, and on the other side to STPs 9 of the SS7 network 8. Whilst the gateway device 10 may be connected to every STP 9 of the SS7 network 8, it is preferred that connection is made to only a subset of all STPs 9 of the SS7  
15 network 8, such that signalling information to be transmitted between a give STP 9 and the gateway device 10 may require routing through one or more intermediate STPs 9. Figure 2 illustrates schematically a possible architecture for the gateway devices 12.

20

It will be appreciated that signalling information to be transmitted from a signalling point of one network 1,2, to a signalling point of the other network, through the TCP/IP network 11, requires protocol conversion at both of the gateway devices 10. More particularly, it is necessary to process signalling messages such that the physical message construction, and associated error detection and correction  
25 processes etc., are appropriate for the medium over which the message is next to be transmitted.

30

Figure 3 illustrates the seven layers (or levels) which compose the SS7 protocol. These layers will not be described here in detail, but rather the reader should make reference to the ITU-T recommendations starting with Q.700. It is sufficient here to note that layers 1 to 3 provide the physical, datalink, and network layers, whilst

layers 4 to 7 provide user parts and application parts which are generally network specific (in particular, the TCAP provides transaction capabilities for services such as INAP, MAP, OMAP, etc.).

5 Figure 4 illustrates the processing layers which are provided at the gateway device 10 in order to provide for the conversion of signalling messages between the SS7 protocol and the TCP/IP protocol. On the SS7 network side of the interface, there is provided the MTP of the SS7 protocol, whilst on the TCP/IP side the MTP is replaced by TCP/IP protocol layers. Signalling messages received at the gateway  
10 device 10 from the SS7 network 8 are thus processed through the MTP to retrieve the signalling information originally generated within an SP of the SS7 network by a user part.

At the gateway device 10, this user part generated data is passed by the MTP to an  
15 intermediate processing layer (identified by reference numeral 13). This layer 13 adds to each signalling message a header (9bits) indicating the number of octets which the message contains. The processed messages are then passed to the TCP/IP protocol layers where they are organised for transmission over the TCP/IP network 11 via the IAS 12. A single TCP/IP datagram may contain several signalling  
20 messages, such that the datagram has the structure illustrated in Table 1 below, and where SIF is the Signalling Information Field and SIO is the Signalling Information Octet.

In the same way, when signalling data is received at a gateway device 10 from the  
25 IAS 12, the signalling information is processed through the TCP/IP layers to recover the user part generated data, with the signalling message length header being removed in the intermediate layer 13, before passing the data to the MTP in preparation for transmission over the SS7 network 8.

30 It is noted that Figure 4 illustrates a user part(s) layer above the MTP and TCP/IP layers. However, this layer is not normally utilised in the gateway device unless the

device is directly connected to a switching exchange 3 such that signalling information can be passed directly from the user parts (e.g. TUP, ISUP, etc.) to the TCP/IP layers and *vice versa*.

- 5 It will also be appreciated that whilst signalling messages are routed in the SS7 network using SS7 Point Codes, messages in the IP network are routed using IP addresses. Gateway devices may therefore be provided with a database mapping point codes to IP addresses, using dynamic updating if necessary.
- 10 Figure 5 illustrates the flow of signalling information associated with set up and termination of a call between the two telephones 6,7 of Figure 1, where the signalling points are identified using the same symbols as are used in Figure 1. Figure 6 is a flow diagram illustrating the signalling process described above.
- 15 It will be appreciated by the person of skill in the art that modifications may be made to the above described embodiments without departing from the scope of the present invention. For example, whilst the user voice or data channel has been described above as being a circuit switched channel (E.1/T.1), this channel may be provided, in whole or in part, by a packet switched channel, e.g. where the call is
- 20 made from or to a mobile telephone registered with a mobile network utilising the proposed General Packet Radio Service (GSM phase 2+).

IP header			
TCP header			
Octets, 9bits	Spare, 7bits	SIO, 8bits	SIF
8n (2=>n=>272			
:			
:			
:			
Octets, 9bits	Spare, 7bits	SIO, 8bits	SIF
8n (2=>n=>272			
SIF cont.			

5

Table 1

Claims

1. A method of transmitting signalling information between signalling points of a telecommunications system, the method comprising transmitting signalling  
5 information between said signalling points via Internet Protocol (IP) based network.
2. A method according to claim 1, further comprising transmitting signalling information from a first signalling point to a first gateway.
- 10 3. A method according to any of the preceding claims, further comprising formatting the signalling information at the first gateway into a format suitable for transmission over an IP network.
4. A method according to any of the preceding claims, further comprising  
15 transmitting the formatted information from the first gateway to a second gateway over an IP network.
5. A method according to any of the preceding claims, further comprising receiving the formatted information at the second gateway and recovering therefrom  
20 the original signalling information.
6. A method according to any of the preceding claims, further comprising transmitting the recovered signalling information to a second signalling point.
- 25 7. A method according to any of the preceding claims, wherein the signalling information being associated with a subscriber-to-subscriber voice or data traffic channel carried by a first transmission network.
8. A method according to claim 7, wherein said first transmission network is a  
30 circuit switched network.

9. A method according to any of the preceding claims, wherein said signalling points between which the user call information and the signalling information is transmitted are switching points of the telecommunication system.

5

10. A method according to any of the preceding claims and comprising transmitting signalling information between said signalling points in part via a packet switched signalling network different from said IP based network, signalling information being converted from one format to another at the signalling network interfaces.

10

11. A method according to claim 10, wherein said packet switched signalling network is Signalling System No. 7 (SS7) based network.

15

12. A method according to claim 11 and comprising transmitting signalling information between a group of locally arranged signalling points using an SS7 network, whilst transmitting signalling information intended for signalling points outside the local area to a gateway device which provides an interface between the SS7 network and the IP network.

20

13. A method according to any of the preceding claims, wherein the signalling information transmitted through the IP network comprises signalling information associated with call set-up and call termination in the first transmission network of the telecommunications system.

25

14. An apparatus for transmitting signalling information between signalling points of a telecommunications system, the apparatus comprising:

an Internet Protocol (IP) based network forming at least part of a transmission link between said signalling points; and

means for transmitting signalling information between said signalling points via the IP based network.

15. An apparatus according to claim 14, further comprising a gateway device  
5 coupled to a signalling point and also to an Internet Protocol (IP) based network,  
wherein the gateway device is arranged to receive signalling information  
from said signalling point coupled thereto and to convert that information into a  
format suitable for transmission over the IP network and to perform a reverse  
conversion for signalling information from the IP network.
- 10 16. An apparatus according to claim 15, wherein the gateway device is a  
Signalling System No.7 (SS7)/Internet Protocol (IP) gateway device.
17. An apparatus according to claims 15 or 16, wherein the gateway device is a  
15 standalone device.
18. An apparatus according to any one of claims 15-17, wherein the gateway  
device is integrated into respective signalling point.
- 20 19. An apparatus according to any one of claims 15-18, wherein the gateway  
device is coupled to the IP network via respective Internet Access Server (IAS).
20. An apparatus according to claim 19, wherein the gateway device is coupled  
to respective IAS via packet switched data links.
- 25 21. An apparatus according to any one of claims 15-20, wherein the gateway  
device is coupled to respective signalling point via PCM or TDMA links.
22. An apparatus according to any one of claims 15-21, wherein the gateway  
30 device is provided with conversion means for converting between: the ISUP



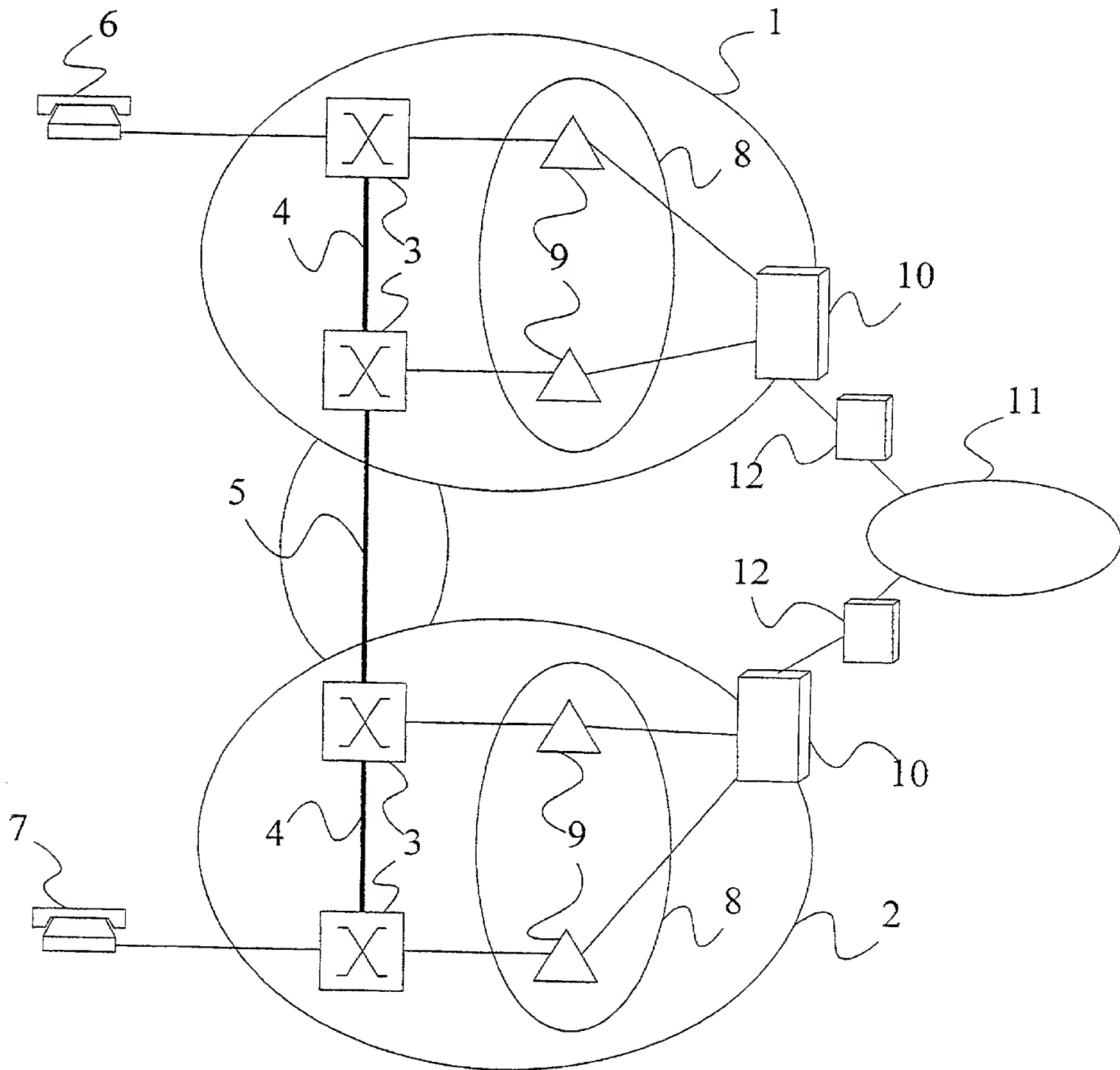
messaging format and the SIP messaging format; an H.323 messaging format and the SS7 call set-up format; ISUP and a network access server control protocol; or between ISUP and a voice-over-IP control protocol.

5 23. An apparatus according to any one of the claims 15-22, wherein the gateway device may be provided with an interface for tunnelling SS7 application part messages over IP.

10 24. An apparatus according to any one of the claims 15-23, wherein the gateway device is arranged to determine the IP routing address for a received message or series of messages from one or more of: the Signalling Link Selection + Service Information Octet; Subsystem number; and Global Title Translation.

15 25. An apparatus according to any one of the claims 14-24, wherein signalling information is associated with a subscriber-to-subscriber voice or data traffic channel carried by a first transmission network.

20 26. A method of communicating voice and other user information between a pair of end users, a first of the end users having a circuit switched connection to a telecommunications network and the second of the end users having a packet switched connection to an IP network, the method comprising exchanging signalling information between the telecommunications network and the IP network via a gateway device arranged to convert the signalling data between a voice-over-IP format and a SS7 format.

Figure 1

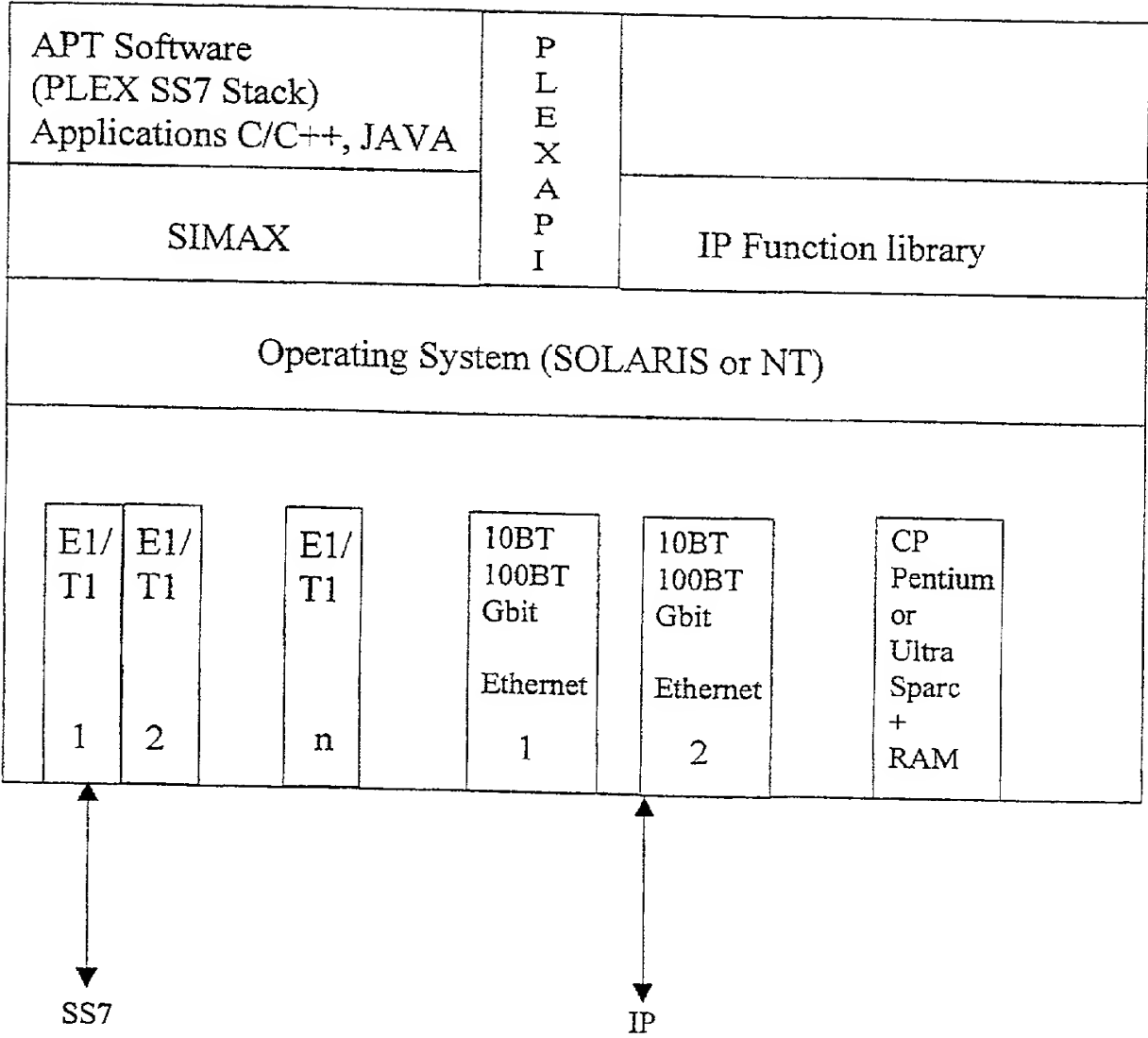


Figure 2

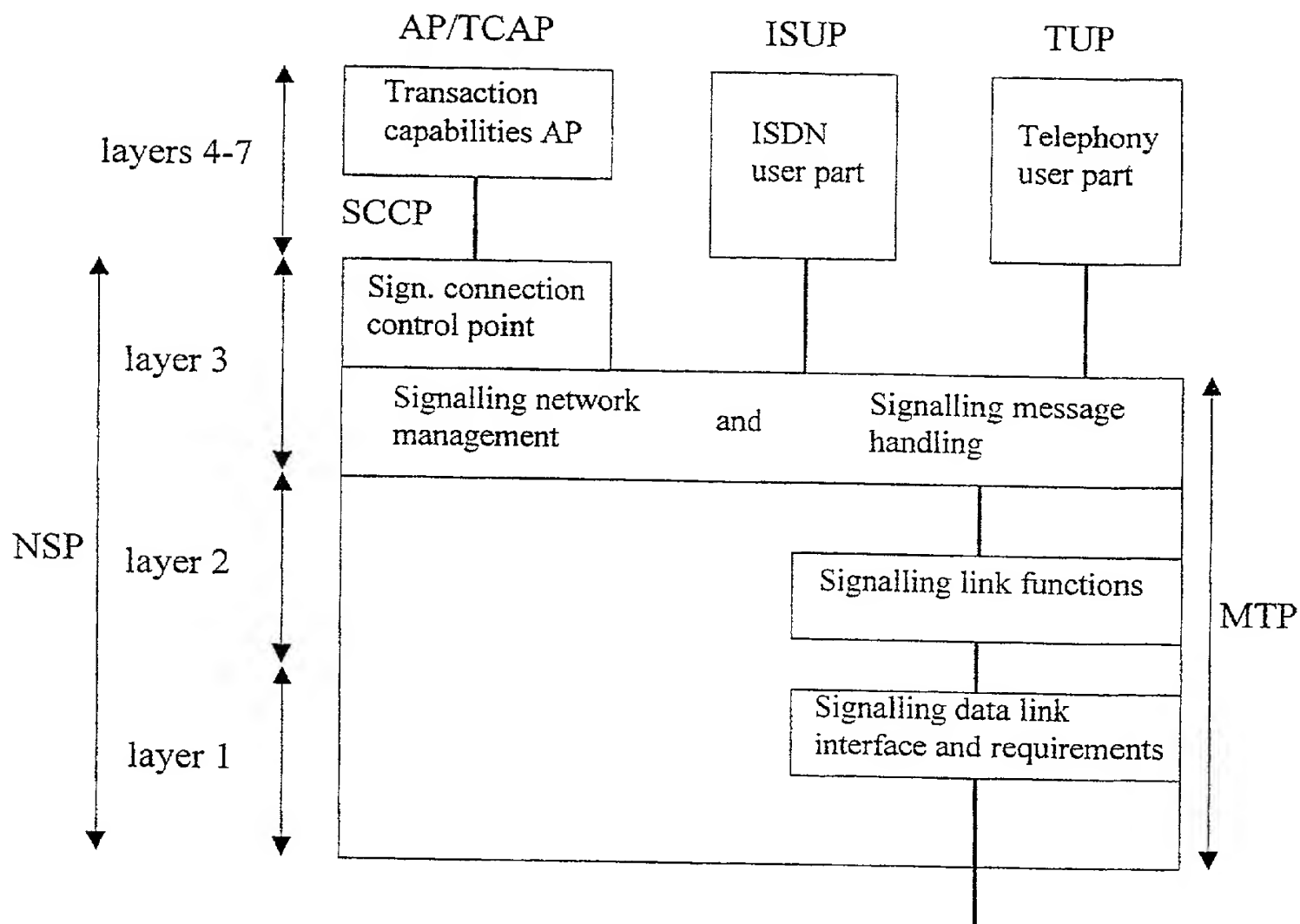


Figure 3

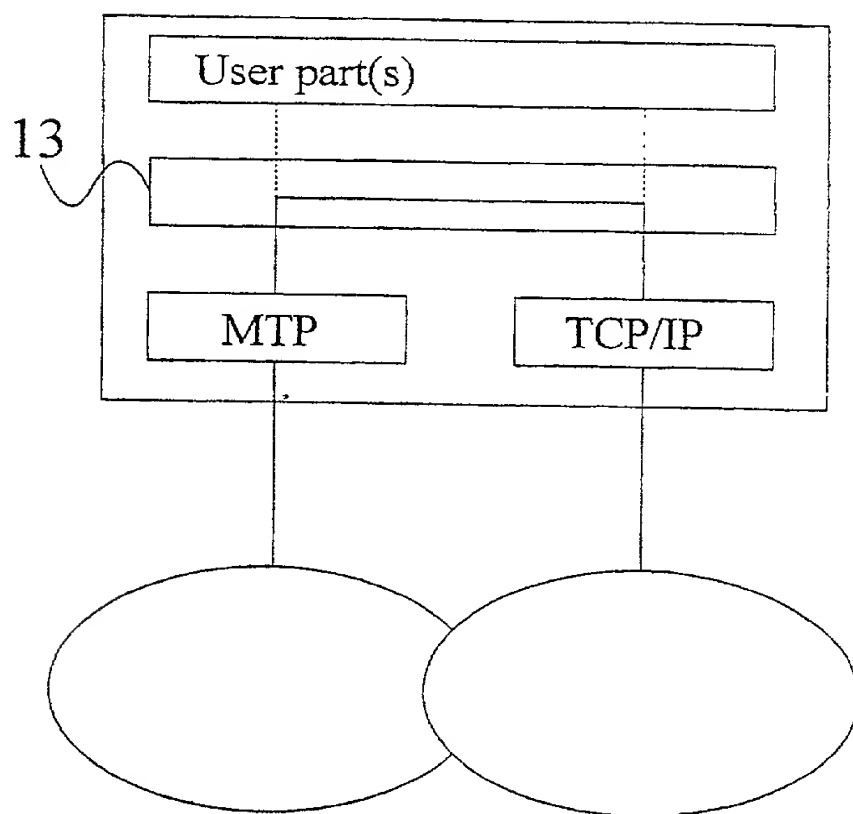


Figure 4

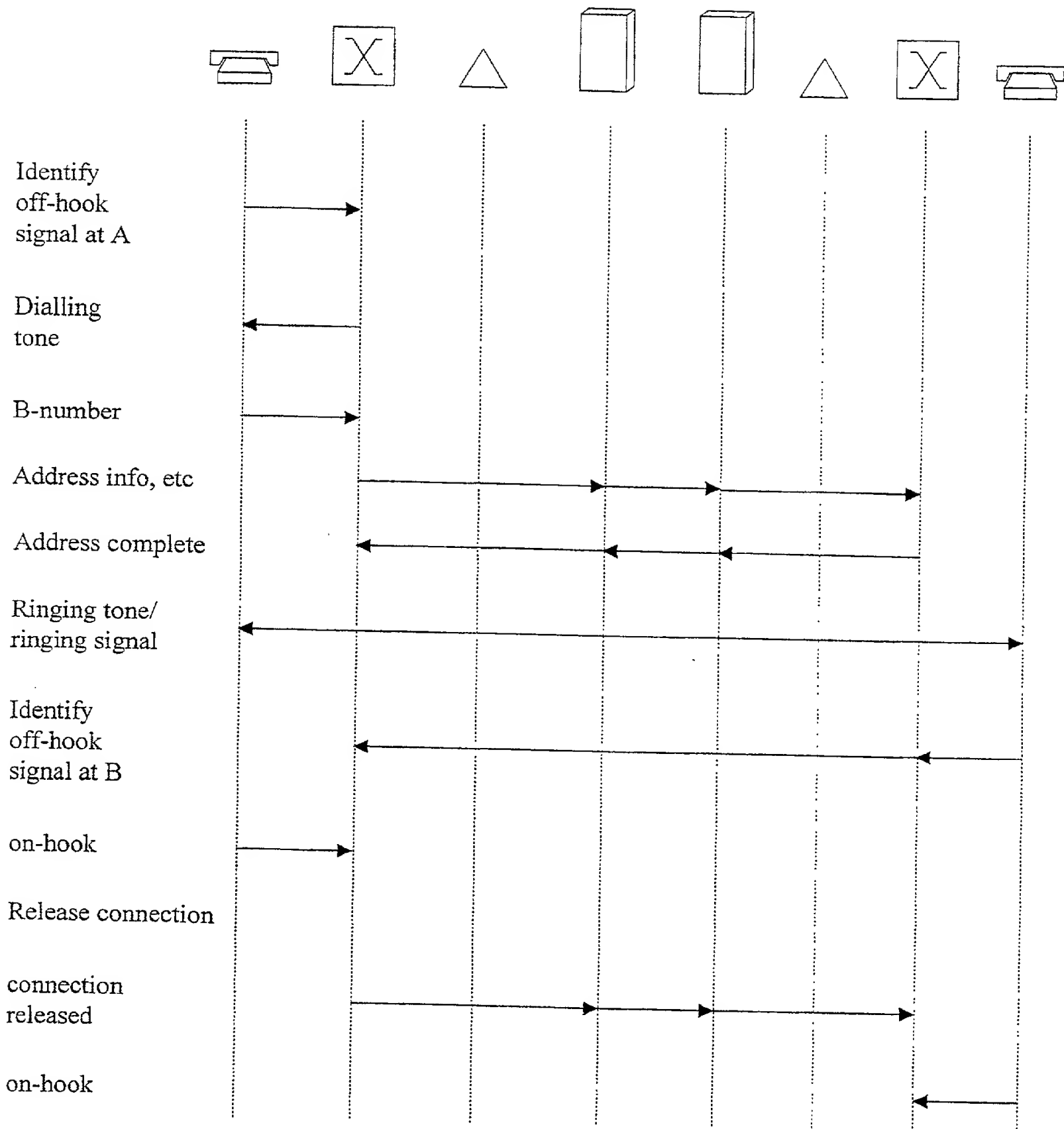
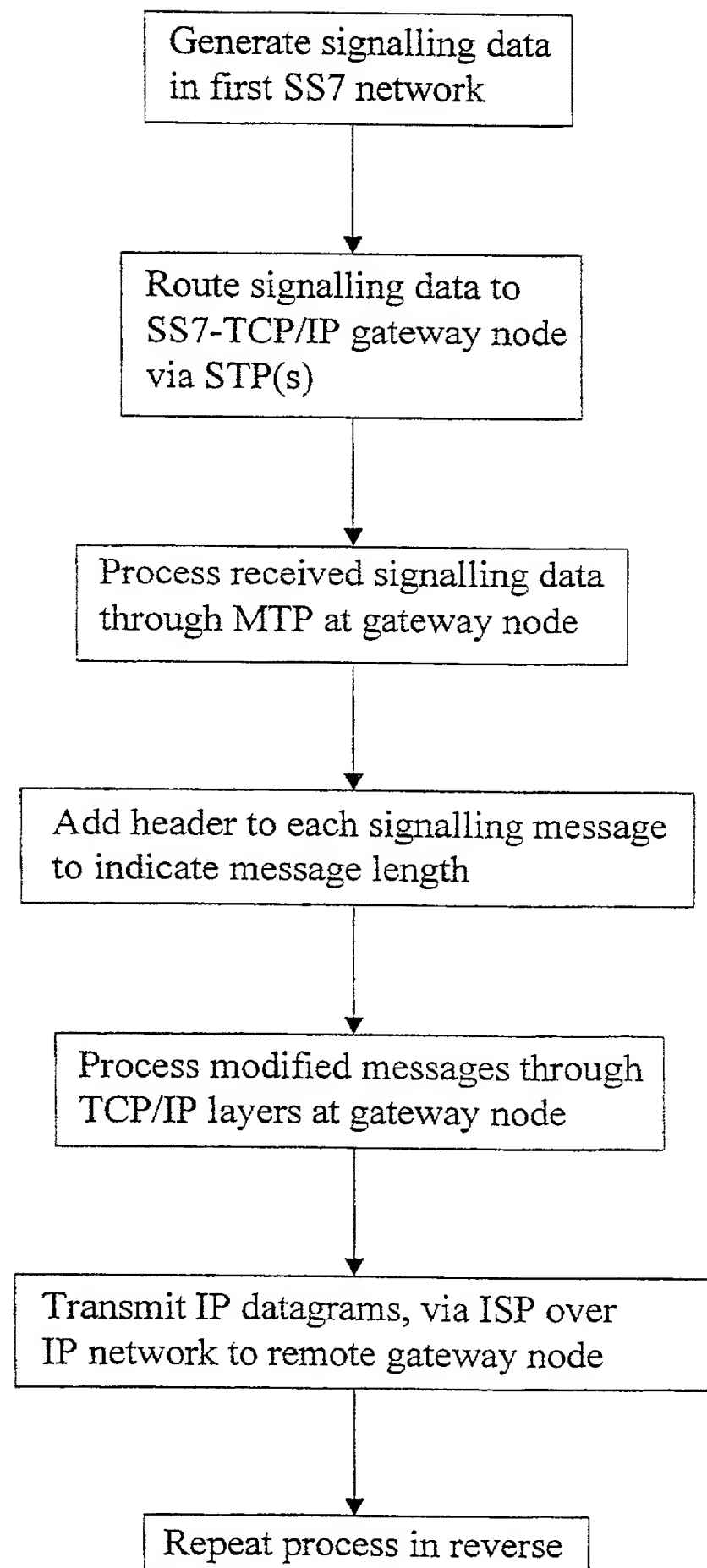


Figure 5

5/5

Figure 6

**COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY**  
(Includes Reference to Provisional and PCT International Applications)

Attorney's Docket No.  
027566-025

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name;

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

SIGNALLING IN A TELECOMMUNICATIONS SYSTEM

the specification of which (check only one item below):

☐ is attached hereto.

☒ was filed as United States application

Number 09/787,762

on March 22, 2001

and was amended

on \_\_\_\_\_ (if applicable).

☐ was filed as PCT international application

Number \_\_\_\_\_

on \_\_\_\_\_

and was amended

on \_\_\_\_\_ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, §119 (a)-(e) of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed:

**PRIOR FOREIGN/PCT APPLICATION(S) AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. §119:**

COUNTRY (if PCT, indicate "PCT")	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED UNDER 35 U.S.C. §119
Finland	982073	25 September 1998	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Finland	982368	30 October 1998	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
			<input type="checkbox"/> Yes <input type="checkbox"/> No
			<input type="checkbox"/> Yes <input type="checkbox"/> No
			<input type="checkbox"/> Yes <input type="checkbox"/> No

I hereby claim the benefit under Title 35, United States Code § 119(e) of any United States provisional application(s) listed below.

\_\_\_\_\_  
(Application Number)

\_\_\_\_\_  
(Filing Date)

\_\_\_\_\_  
(Application Number)

\_\_\_\_\_  
(Filing Date)

**COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY (CONT'D)**  
(Includes Reference to Provisional and PCT International Applications)

Attorney's Docket No.  
027566-025

I hereby claim the benefit under Title 35, United States Code, §120 of any United States applications(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose to the Office all information known to me to be material to the patentability as defined in Title 37, Code of Federal Regulations §1.56, which became available between the filing date of the prior application(s) and the national or PCT international filing date of this application:

PRIOR U.S. APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. §120:

U.S. APPLICATIONS		STATUS (check one)		
U.S. APPLICATION NUMBER	U.S. FILING DATE	PATENTED	PENDING	ABANDONED
PCT APPLICATIONS DESIGNATING THE U.S.				
PCT APPLICATION NO.	PCT FILING DATE	U.S. APPLICATION NUMBERS ASSIGNED (if any)		
PCT/FI99/00790	24 September 1999	09/787,762	X	

I hereby appoint the following attorneys and agent(s) to prosecute said application and to transact all business in the Patent and Trademark Office connected therewith and to file, prosecute and to transact all business in connection with international applications directed to said invention:

William L. Mathis	17,337	Eric H. Weisblatt	30,505	Bruce T. Wieder	33,815
Robert S. Swecker	19,885	James W. Peterson	26,057	Todd R. Walters	34,040
Platon N. Mandros	22,124	Teresa Stanek Rea	30,427	Ronni S. Jillions	31,979
Benton S. Duffett, Jr.	22,030	Robert E. Krebs	25,885	Harold R. Brown III	36,341
Norman H. Stepno	22,716	William C. Rowland	30,888	Allen R. Baum	36,086
Ronald L. Grudziecki	24,970	T. Gene Dillahunty	25,423	Steven M. duBois	35,023
Frederick G. Michaud, Jr.	26,003	Patrick C. Keane	32,858	Brian P. O'Shaughnessy	32,747
Alan E. Kopecki	25,813	B. Jefferson Boggs, Jr.	32,344	Kenneth B. Leffler	36,075
Regis E. Slutter	26,999	William H. Benz	25,952	Fred W. Hathaway	32,236
Samuel C. Miller, III	27,360	Peter K. Skiff	31,917	Wendi L. Weinstein	34,456
Robert G. Mukai	28,531	Richard J. McGrath	29,195	Mary Ann Dillahunty	34,576
George A. Hovanec, Jr.	28,223	Matthew L. Schneider	32,814		
James A. LaBarre	28,632	Michael G. Savage	32,596		
E. Joseph Gess	28,510	Gerald F. Swiss	30,113		
R. Danny Huntington	27,903	Charles F. Wieland III	33,096		



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and:

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Ronald L. Grudziecki, Esq.  
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Alexandria, Virginia 22313-1404

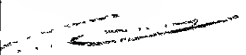
Address all telephone calls to: Steven M. duBois at (703) 836-6620.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.



**COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY (CONT'D)**  
(Includes Reference to Provisional and PCT International Applications)

Attorney's Docket No.  
027566-025

FULL NAME OF SOLE OR FIRST INVENTOR Tomas MECKLIN		SIGNATURE 		DATE 17/5/2001
RESIDENCE Laaksoalahdentie 11 E, FIN-02720 Espoo, FINLAND		CITIZENSHIP Finnish		
POST OFFICE ADDRESS Laaksoalahdentie 11 E, FIN-02720 Espoo, FINLAND				
FULL NAME OF SECOND JOINT INVENTOR, IF ANY Veli-Pekka HEINONEN		SIGNATURE		DATE
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POST OFFICE ADDRESS Ajurinkuja 5 D 32, FIN-02600 Espoo, FINLAND				
FULL NAME OF THIRD JOINT INVENTOR, IF ANY Roger Raimond FÖRSTRÖM		SIGNATURE		DATE
RESIDENCE Skolängsvägen 8, FIN-10410 Aminnefors, FINLAND		CITIZENSHIP Finnish		
POST OFFICE ADDRESS Skolängsvägen 8, FIN-10410 Aminnefors, FINLAND				
FULL NAME OF FOURTH JOINT INVENTOR, IF ANY Leif Erik BJÖRKLUND		SIGNATURE		DATE
RESIDENCE Avaruuskatu 3 H 150, FIN-02210 Espoo, FINLAND		CITIZENSHIP		
POST OFFICE ADDRESS Avaruuskatu 3 H 150, FIN-02210 Espoo, FINLAND				
FULL NAME OF FIFTH JOINT INVENTOR, IF ANY		SIGNATURE		DATE
RESIDENCE		CITIZENSHIP		
POST OFFICE ADDRESS				
FULL NAME OF SIXTH JOINT INVENTOR, IF ANY		SIGNATURE		DATE
RESIDENCE		CITIZENSHIP		
POST OFFICE ADDRESS				
FULL NAME OF SEVENTH JOINT INVENTOR, IF ANY		SIGNATURE		DATE
RESIDENCE		CITIZENSHIP		
POST OFFICE ADDRESS				
FULL NAME OF EIGHTH JOINT INVENTOR, IF ANY		SIGNATURE		DATE
RESIDENCE		CITIZENSHIP		
POST OFFICE ADDRESS				

8314PC-02  
LMF 98082**COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY**  
(Includes Reference to Provisional and PCT International Applications)Attorney's Docket No.  
027566-025

As a below named inventor, I hereby declare that:

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the specification of which (check only one item below):

☐ is attached hereto.☒ was filed as United States applicationNumber 09/787,762on March 22, 2001

and was amended

on \_\_\_\_\_ (if applicable).

☐ was filed as PCT international application

Number \_\_\_\_\_

on \_\_\_\_\_

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(Application Number)

(Filing Date)

(Application Number)

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Norman H. Stepio	22,716	William C. Rowland	30,888	Allen R. Baum	36,086
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**COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY (CONT'D)**  
 (Includes Reference to Provisional and PCT International Applications)

 Attorney's Docket No.  
 027566-025

FULL NAME OF SOLE OR FIRST INVENTOR		SIGNATURE	DATE
Tomas MECKLIN			17/5/2001
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Laaksoahdentie 11 E, FIN-02720 Espoo, FINLAND		Finnish	
POST OFFICE ADDRESS			
Laaksoahdentie 11 E, FIN-02720 Espoo, FINLAND			
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Veli-Pekka HEINONEN			17.05.2001
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Ajurinkuja 5 D 32, FIN-02600 Espoo, FINLAND		Finnish	
POST OFFICE ADDRESS			
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Roger Raimond FÖRSTRÖM			23/5/2001
RESIDENCE		CITIZENSHIP	
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POST OFFICE ADDRESS			
Skolängsvägen 8, FIN-10410 Aminnefors, FINLAND			
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Leif Erik BJÖRKLUND			17/5/2001
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FULL NAME OF FIFTH JOINT INVENTOR, IF ANY		SIGNATURE	DATE
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RESIDENCE		CITIZENSHIP	
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RESIDENCE		CITIZENSHIP	
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